With two or three exceptions all are more distant than a thousand light years, and a few are at exceptionally great distances from the plane of the Milky Way.

HARLOW SHAPLEY.

ON THE VARIATIONS IN THE PERIODS OF VARIABLE STARS IN MESSIER 3. (ABSTRACT)

Several series of plates have been secured with the 60-inch reflector to supplement the work of Professor Bailey on the periods of the variable stars in *Messier* 3. The interval of twenty-one years since the first observations at Harvard affords an opportunity to test for irregularities or secular variations. A number of cases of changing light-elements have been found; and, in fact, with the progress of such work on short period variables it appears likely that long-period fluctuations in the length of the period may be found to be the rule rather than the exception. There is some danger, however, of confusing the more or less transient irregularities in the maxima with the secular perturbations of the mean period.

HARLOW SHAPLEY AND HELEN DAVIS.

FIVE SOUTHERN SPECTROSCOPIC BINARIES AND LIGHT VARIABLES OF THE δ CEPHEI CLASS. (ABSTRACT)

A very distinctive phenomenon characterizes the class of light variables and spectroscopic binaries of which *δ Cephei* is typical. This characteristic is the approximate coincidence of maximum light with maximum velocity of approach in orbital motion. Eighteen (or more) stars are now known to have this characteristic but all except one are brighter than magnitude 6.3 at maximum. Many of the *Cepheid* variables are in the far southern skies but have not been found to be spectroscopic binaries because too faint to be conveniently observed with the spectroscope. Five, however, have been observed at Santiago, Chile, sufficiently to demonstrate orbital motion and the particular characteristic of the *Cepheid* binaries, as described above. These five are all fainter than magnitude 6.3 at maximum and diminish not more than one magnitude to minimum. They are as follows:

	Variable	Magnitude	Light Period	Spectrum
S	*Muscae*	6.4–7.3	9.6+ days	F8p
R	*Trianguli Australis*	6.7–7.4	3.3+	F5 to G5
S	*Trianguli Australis*	6.4–7.4	6.3+	G5
S	*Normae*	6.6–7.6	9.7+	G
RV	*Scorpii*	6.7–7.4	6.0+	F5 to G5

Besides the principal characteristic mentioned above, the observations of their radial velocities show that their orbits are similar in that they have eccentricities of two- or three-tenths and similar ranges of velocity, that is, amplitudes of more or less thirty kilometers. These properties are also important characteristics of the *Cepheid* binary-variables.

G. F. PADDOCK.

PROBABLE ERRORS IN MERIDIAN CIRCLE OBSERVATIONS. (ABSTRACT)

The comparison of fourteen hundred readings of both circles, in the fundamental work of the years 1905 and 1906, gives the probable error of a difference of the two simultaneous circle readings, $\pm$ 0″.35. The settings on seventy-seven dates, with an average of eighteen each date, are included. The movable circle was shifted about one degree after each date. The errors include the effect of division errors of both circles, but the bisection error upon star or nadir would be the same for both circles, and does not enter this result.

The distribution of the errors has been tested by the count of the residuals, which checks the final result, and the agreement of observation with theory.

COUNT OF RESIDUALS.

Under 0″.35 = p. e.	Count	727	Theory	701
0″.35 to 0″.70 = 1 to 2 times p. e.	"	441	"	453
0.71 to 1.05 = 2 to 3 " "	"	169	"	188
1.06 to 1.40 = 3 to 4 " "	"	48	"	50
1.41 to 1.76 = 4 to 5 " "	"	15	"	9
Over 5 times p. e. [5.5 and 5.7]	"	2	"	1
Sum	"	1402	"	1402

The residuals of largest size are slightly in excess of theory, which is a common result of experience in handling the results of probable error discussions, and is due to the accumulation of all the unfavorable conditions in some few instances.

The graduations are alike on both circles, and subject to the same class of errors, and the above error can be distributed, $\pm$ 0″.25 for either circle. The probable error of graduation is $\pm$ 0″.19 for the mean of four divisions, as derived in the final measures of graduation errors, and confirmed quite precisely by recent observations of a list of six hundred stars in both positions of the instrument, fixed circle east and fixed circle west. There remains $\pm$ 0″.16 for the probable error of a circle reading under